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Applicant(s): Harper
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Examiner: Tung, Kee M
Title: METHODS AND APPARATUS FOR SIMULTANEOUS IMAGE CAPTURE AND IMAGE DISPLAY IN AN IMAGING DEVICE
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Commissioner for Patents
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APPEAL BRIEF

i. REAL PARTY IN INTEREST

The real party in interest is Hand Held Products Inc.

ii. RELATED APPEALS AND INTERFERENCES

There are no related Appeals or Interferences.

iii. STATUS OF THE CLAIMS

Claims 1-3, 5-10, 12, 14-16, 18-20, 23-25, and 27-52 stand rejected.

Claims 4, 11, 13, 17, 21, 22, and 26 have been cancelled.

iv. STATUS OF AMENDMENTS

No amendments have been filed subsequent to the current final rejection.

v. SUMMARY OF CLAIMED SUBJECT MATTER

Currently claims 1, 7, 15, 28, 33, 46, are independent.

Claim 1:

An imaging device is claimed for simultaneous image capture and display updating. An imager captures image data based upon a command from a central processing unit. A first image buffer stores first-in-time captured image data prior to display thereof. A second image buffer stores second-in-time captured image data prior to display thereof. An image enhancer enhances image data in the first and second buffers prior to display.

Claim 7:

Recites a method in which first-in-time image data is captured to a first buffer and second-in time image data is captured to a second buffer. The first-in-time image data is displayed while the second-in-time image data is captured. Additionally, the first-in-time image data is enhanced after capture.

Claim 15:

Recites a method in which first-in-time image data is captured to a first buffer and second-in time image data is captured to a second buffer. The first-in-time image data is displayed while the second-in-time image data is captured. Additionally, the first-in-time image data is enhanced after capture and prior to display. Third-in-time image data is captured to the first buffer. The claim further recites issuing and executing various commands to accomplish the foregoing actions.

Claim 28:

Recites an imaging device with an imager, a CPU, and a memory module. The memory module includes first and second image capture buffers for storing first-in-time image data and second-in-time image data respectfully.

Claim: 33

Recites a portable data acquisition and display device comprising a memory unit including a plurality of image buffers. The device comprises an imaging barcode reader, a processor, a memory unit, and a display device. A controller controls image data in the plurality of image capture buffers such that first image data is stored in a first image capture buffer, second image data is stored in a second image capture buffer while the first image data is being distributed from the first image capture buffer to the display, and third image data is stored in one of the plurality of image capture buffers while the second image data is being distributed from the second image capture buffer to the display.

Claim: 46

Recites a method for image capture and display using a plurality of image buffers. The method is implemented with reference to an imaging barcode reader. The method basically sets forth that as one image is captured to a buffer, another image is displayed from a different buffer.

vi. GROUND OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-3, 5-10, 12, 14-16, 18-20, 23-25, and 27-52 under 35 USC §103(a) as being unpatentable over the Admitted Prior Art and Rao et al.

vii. ARGUMENT

Claims 1-3, 5-10, 12, 14-16, 18-20, 23-25, and 27-52 are patentable under 35 USC §103(a) over the Admitted Prior Art and Rao.

Description of the Admitted Prior Art and Problems Associated Therewith

The admitted prior art teaches an imaging device in which a single memory buffer is used to store a series of frames of image data. Taking for example portable bar code readers having image display capabilities, image capture is usually a two stage affair. The first stage is referred to in the specification as aiming. During aiming, a live view of the frames captured by the imager is displayed on a screen. Once a user is satisfied with the image, he or she will initiate the second stage: final capture. In final capture a last (e.g. final) frame is captured, saved and, in the case of a bar code read operation – analyzed to identify the contents of the bar code. However, should the frame being displayed at the time the user decided to initiate final capture not correspond to a most recently captured frame (or frame to be captured), the resultant image from the final frame may not meet the user's expectations.

The image capture process happens on a somewhat fixed time schedule, for example, every 33 milliseconds. Once an image is captured, it must be processed/enhanced prior to display on an associated screen. At a minimum, the captured image is resized based on a size and resolution of the display (and the amount of screen real estate dedicated to displaying the captured image). Other enhancement may include adjustment of the image contrast or sharpening the image, typically by implementing a filtering scheme. If the processing and painting of a prior frame is not completed prior to the capture of a subsequent frame, that subsequent frame is not placed into the buffer and therefore not displayed. Repeated failure to display captured frames leads to a lag in the display.

If the displayed image significantly lags the image currently being captured, the users expectations with respect to content of an finale capture may not be met. For example, if the user initiates final capture when the display shows a barcode centered therein, the user reasonably expects that the captured image includes a complete copy of a barcode. But, if there is a lag in the display, a portion of the barcode may not have been captured because the imager shifted subsequent to the period in time in which the displayed image was captured. In this case the user was not presented with up-to-date information and, as such, made a poor choice in initiating the final capture. The present invention seeks to ensure that the user has enough information to decide when to initiate final capture it is desirable to ensure that the maximum amount of captured frames are timely displayed to the user.

Description of Rao

Rao is directed toward a typical processing system in a PC system. In particular, Rao is directed toward relieving the CPU of the burden of transferring data from system memory to a frame buffer in a display controller. As set forth at page 3, lines 17 through 25, prior to Rao, multiple CPU cycles were required for each word of data to be transferred. These cycles would be useful to other processes executed by the CPU. The solution presented by Rao is to dedicate normal system memory as a frame buffer, e.g. by co-locating the system memory and the frame buffer onto a single integrated circuit.

Rao further teaches the use of two memory blocks. One block is used for screen refresh by either the display controller or the CPU. The second block is used for display data update. The CPU can update the data in the update frame while the refresh buffer is providing data for refresh of the display screen.

Rebuttal of Obviousness

According to M.P.E.P. §2143, to set forth a Prima Facie case of obviousness, the Examiner must satisfy three basic criteria:

> 1) there must be some suggestion or motivation to modify the reference or to combine reference teachings;
>
> 2) there must be a reasonable expectation of success; and
>
> 3) the prior art references (or references when combined) must teach or suggest all of the claim limitations.

In the present application, the Applicants respectfully submit that the Examiner has failed to express an adequate suggestion or motivation to combine the Admitted Prior Art with Rao.

The Examiner indicates that it "would have been obvious to one of ordinary skill in the art at the time the present invention was made to combine the teachings of Rao into the system of the prior art because double buffering technique provides advantageous over the single buffering technique by allowing concurrent update from one of the buffer and refresh from another buffer as taught by Rao." The Examiner further states the "advantage of double buffering technique over the single buffer system is old and well known in the art... One of the motivation or advantages provided by Rao is that double buffering provides concurrent update one of the buffers and refresh from another buffer (see pages 5-9), which identifies and solves the same problem as applicant and thus prove the examiner is not using hindsight."

Rao is not Analogous to the Claimed Subject Matter

The inquiry into motivation starts with a determination as to whether a reference is either in the field of the applicant's endeavor or is reasonably pertinent to the problem with which the inventor was concerned. In re Oetiker, 977 F.2d 1443, 1447 (Fed. Cir. 1992).

As set forth in the field of the invention section, the present invention is directed toward processing of image data in an imaging system and, more particularly, to a method and apparatus for providing simultaneous image capture and image display processing in an imager device through the implementation of a dual capture buffers. Rao is not directed toward capturing and displaying images. Rather, it is directed toward a display subsystem and, in particular, to unified system/frame buffer memories. Rao makes no mention of imagers or data captured by an imager. Applicants believe that Rao is directed toward typical desktop PCs as opposed to imaging devices (claim 1, 7, 15, and 28) including portable data acquisition and display devices (claim 33) and imaging barcode reader devices (claim 46). Rao is not in the field of Applicant's endeavor nor does Rao set itself forward as being reasonably pertinent to the problem addressed by the present invention.

There is no Suggestion, Motivation, or Teaching to Combine Rao with the Admitted Prior Art

Even should Rao be considered analogous art to the Admitted Prior Art, the Examiner is still required to find some suggestion, motivation, or teaching to combine the references. The motivation-suggestion-teaching test picks up where the analogous test leaves off, *see* In re Kahn (Fed. Cir. 2006, 04–1616). In the present case, the Examiner has not cited any suggestion or teaching - as such - the argument lies as to whether there is motivation to combine the references.

The present invention seeks to provide additional frames of images to users of imaging devices during an aiming mode. In an imaging device, the ability to paint the frames to a screen is first dictated by the ability of the imager to deliver said frames and secondly by the ability to process these frames and make them available for painting. The present invention focuses on the second portion by providing multiple buffer and methods of user therefore.

The general problem recognized by the present inventors (that of lag) is not a problem recognized or even experienced by the system of Rao. Applicant's respectfully submit that there is nothing in the disclosure of Rao that would lead one of ordinary skill in the art to believe that a solution to the problem identified by Applicants would lie therein. As the disclosure of Rao is directed to a different purpose and problem (general or otherwise) from the present invention, the present inventors had no motivation or occasion to consider it.

Rao is seeking to optimize memory usage and reduce CPU usage. *see page 3 line 17 through page 4 line 22.* Timing does not appear to be a problem identified or addressed by Rao. Referring to page 8 line 25 et seq., Rao identifies the following advantageous: saving CPU operating cycles thereby freeing the CPU to perform other operations and the efficient construction and operation of memory spaces thereby minimizing unused memory space allowing for more compact systems. Applicant has reviewed Rao and has been unable to locate any indication that the system described therein would increase the refresh rate of the display or reduce dropped frames.

There is nothing in Rao which indicates that the ideas presented therein would solve, or is even applicable to, the problems faced by the Inventors in the present application. Similarly, there is nothing in the Admitted Prior Art which would motivate one of ordinary skill in the art to try the ideas presented in Rao.

As there is nothing in either the Admitted Prior Art or Rao that would provide motivation for the Examiner's proposed combination, the Examiner has failed to present a Prima Facie case of Obviousness.

CLOSING REMARKS

It may be said that invention lies in the recognition that the methods Rao teaches for optimizing memory usage and reducing CPU load would – in an imaging system – solve the problem of dropped frames presented to a user in an aiming mode. There is nothing in either the admitted prior art which would indicate that such a combination would either be desirable or successful in reducing or eliminating lag. Accordingly, the Applicant believes that there is no motivation for such combination. Absent such motivation – the Examiner's rejection must fail.

In accordance with the foregoing it is respectfully submitted that all outstanding objections and rejections do not rise to the level of Prima Facie cases of anticipation or obviousness. Accordingly, Applicant requests that the Board instruct the Examiner to withdraw each of the outstanding rejections and pass the subject application to issuance.

If any further fees are required in connection with the filing of this Brief, please charge same to our Deposit Account No. 50-1078.

Respectfully submitted,

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I hereby certify that this correspondence is being electronically transmitted to the Patent and Trademark Office on the date Shown below.

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viii. CLAIMS APPENDIX

1. An imaging device for simultaneous image capture and image display updating, the device comprising:

an imager for capturing image data;

a central processing unit (CPU) in communication with the imager and issues commands to capture image data;

a direct memory access module in communication with the imager and the CPU;

a first image capture buffer, accessible to the CPU, that temporarily stores first-in-time captured image data prior to displaying first-in-time image data;

a second image capture buffer, accessible to the CPU, that temporarily stores second-in-time captured image data prior to displaying second-in-time image data; and

an image enhancer for enhancing image data stored in the first and second image capture buffers prior to display.

2. The image device of Claim 1, further comprising a display that displays to a user first-in-time image data followed by the display of second-in-time image data.

3. The image device of Claim 1, further comprising a field programmable gate array device that implements the direct memory access (DMA) module.

4. (Cancelled)

5. The image capture device of Claim 1, further comprising a means for re-formatting image data stored in the first and second image capture buffers.

6. The image device of Claim 1, wherein the memory module further includes an image display buffer that temporarily stores captured image data that has been enhanced prior to display.

7. A method for simultaneous image capture and image display in an imaging device, the method comprising the steps of:

capturing first-in-time image data to a first image capture buffer that is in communication with an imager;

enhancing the first-in-time image data after capture to the first image capture buffer;

capturing second-in-time image data to a second image capture buffer that is in communication with an imager; and

displaying the enhanced first-in-time image data on a display while the image device captures the second-in time image data to the second image capture buffer.

8. The method of Claim 7, further comprising the steps of:

capturing third-in-time image data to the first buffer once the first-in-time image data is displayed; and

displaying the second-in-time image data on a display while the image device captures the third-in-time image data to the first buffer.

9. The method of Claim 7, wherein capturing first-in-time image data to a first image capture buffer, further comprises the step of:

issuing, at a CPU, a capture command to a DMA module to capture first-in-time image data to the first image capture buffer;

queuing, at the DMA module, the capture command until the DMA module receives an end-of-frame signal;

executing, at the DMA module, the capture command to capture first-in-time image data to the first image capture buffer; and

transferring the first-in-time image data from the imager to the first image capture buffer.

10. The method of Claim 7, wherein capturing second-in-time image data to a second image capture buffer, further comprises the step of:

issuing, at a CPU, a capture command to a DMA module to capture second-in-time image data to the second image capture buffer;

queuing, at the DMA module, the capture command until the DMA module receives an end-of-frame signal;

executing, at the DMA module, the capture command to capture second-in-time image data to the second image capture buffer; and

transferring the second-in-time image data from the imager to the second image capture buffer.

11. (Canceled)

12. The method of Claim 7, further comprising the step of re-formatting the first-in-time image data after capture to the first image capture buffer and before displaying the first-in-time image data on the display.

13. (Canceled)

14. The method of Claim 8, wherein the step of capturing third-in-time image data to the first buffer once the first-in-time image data is displayed, further comprises the steps of:

issuing, at a CPU, a capture command to a DMA module to capture third-in-time image data to the second image capture buffer in response to an EOF signal;

queuing, at the DMA module, the capture command until the DMA module receives an EOF signal;

executing, at the DMA module, the capture command to capture third-in-time image data to the first image capture buffer; and

transferring the third-in-time image data from the imager to the first image capture buffer.

15. A method for simultaneous image capture and image display in an imaging device, the method comprising the steps of:

issuing a first command to capture first-in-time image data to a first image capture buffer;

issuing a second command to capture second-in-time image data to a second image capture buffer;

executing the first capture command:

signaling end-of-frame (EOF) upon the completion of capturing the first-in-time image data to the first image capture buffer;

enhancing the first-in-time image data that is captured in the first image capture buffer;

issuing a third command to capture third-in-time image data to the first image capture buffer;

executing the second capture command; and

displaying the enhanced first-in-time image data to an imaging device display while the imager executes the second command to capture second-in-time image data to the second image capture buffer.

16. The method of Claim 15, further comprising the steps of:

signaling end-of-frame (EOF) upon the completion of capturing the second-in-time image data to the second image capture buffer;

enhancing the second-in-time image data that is stored in the second image capture buffer;

issuing a fourth command to capture fourth-in-time image data to the second image capture buffer;

executing the third capture command; and

displaying the enhanced second-in-time image data to the imaging device display while the imager executes the third command to capture third-in-time image data to the first image capture buffer.

17. (Cancelled)

18. The method of Claim 15, further comprising the step of storing the enhanced first-in-time image data in an image display buffer prior to displaying the first-in-time image data on the image device display.

19. The method of Claim 15, wherein the step of enhancing the second-in-time image data that is stored in the second image capture buffer further comprises the step of reformatting the first-in-time image data that is stored in the first image capture buffer prior to displaying the enhanced first-in-time image data on the image device display.

20. The method of Claim 19, further comprising the step of storing the reformatted first-in-time image data in an image display buffer prior to displaying the enhanced first-in-time image data on the image device display.

21. (Cancelled)

22. (Cancelled)

23. The method of Claim 16, further comprising the step of storing the enhanced second-in-time image data in an image display buffer prior to displaying the second-in-time image data on the image device display.

24. The method of Claim 16, further comprising the step of reformatting the second-in-time image data that is stored in the second image capture buffer prior to displaying the enhanced second-in-time image data on the image device display.

25. The method of Claim 24, further comprising the step of storing the reformatted second-in-time image data in an image display buffer prior to displaying the second-in-time image data on the image device display.

26. (Canceled)

27. The method of Claim 24 , further comprising the step of storing the enhanced and reformatted first-in-time and second-in-time image data in an image display buffer prior to displaying the first-in-time and second-in-time image data on the image device display.

28. An imaging device for substantially simultaneous image capture and image display updating, the device comprising:

an imager for capturing image data upon aiming the imager at an image;

a central processing unit (CPU) that is in communication with the imager and issues commands to capture image data; and

a memory module in communication with the CPU, the memory module including a first image capture buffer, accessible to the CPU, that temporarily stores first-in-time captured image data prior to displaying first-in-time image data and a second image capture buffer, accessible to the CPU, that temporarily stores second-in-time captured image data prior to displaying second-in-time image data.

29. The image device of Claim 28, further comprising a means for enhancing image data stored in the first and second image capture buffers.

30. The image device of Claim 28, wherein the memory module further includes an image display buffer that temporarily stores captured image data that has been reformatted prior to display.

31. The image device of Claim 28, further comprising a direct memory access (DMA) module in communication with the imager, the CPU and the memory module, wherein the DMA module executes the commands to capture image data.

32. The image device of Claim 28, further comprising an image reformatter for re-formatting image data stored in the first and second image capture buffers prior to display.

33. A portable data acquisition and display device, the device comprising:

an imaging barcode reader for capturing image data and decoding bar code symbols;

a processor in communication with the barcode reader;

a memory unit, in communication with the processor, for storing image data captured by the imaging barcode reader, wherein the memory unit includes a plurality of image capture buffers that are configured to store image data;

a display device, in communication with the processor; and

a controller, in communication with the memory unit and the processor, for controlling image data in the plurality of image capture buffers such that

first image data is stored in a first image capture buffer,

second image data is stored in a second image capture buffer while the first image data is being distributed from the first image capture buffer to the display, and

third image data is stored in one of the plurality of image capture buffers while the second image data is being distributed from the second image capture buffer to the display.

34. The device of Claim 33, wherein the controller for controlling image data in the plurality of image capture buffers such that third image data is stored in one of the plurality of image capture buffers while the second image data is being distributed from the second image capture buffer to the display further defines the one of the plurality of image capture buffers as the first image capture buffer.

35. The device of Claim 33, wherein the controller for controlling image data in the plurality of image capture buffers such that third image data is stored in one of the plurality of image capture buffers while the second image data is being distributed from the second image capture buffer to the display further defines the one of the plurality of image capture buffers as a third image capture buffer.

36. The device of Claim 34, wherein the controller for controlling image data in the plurality of image capture buffers further comprises controlling image data in the image capture buffers such that fourth image data is stored in one of the plurality of buffers while the third image data is being distributed from the first image capture buffer to the display.

37. The device of Claim 35, wherein the controller for controlling image data in the plurality of image capture buffers further comprises controlling image data in the image capture buffers such that fourth image data is stored in one of a plurality of buffers while the third image data is being distributed from the third image capture buffer to the display.

38. The device of Claim 33, wherein the controller is further defined as controlling image data in the plurality of image capture buffers such that first image data is stored in a first image capture buffer, second image data is stored in a second image capture buffer substantially simultaneous with the first image data being distributed

from the first image capture buffer to the display, and third image data is stored in one of the plurality of image capture buffers substantially simultaneous with the second image data being distributed from the second image capture buffer to the display.

39. The device of Claim 33, wherein the controller includes an image processing module for processing the image data.

40. The device of Claim 39, wherein the image processing module provides for enhancement of the image data.

41. The device of Claim 39, wherein the image processing module provides for reformatting of the image data.

42. The device of Claim 33, wherein the portable data acquisition and display device is further defined as a handheld device.

43. The device of Claim 33, wherein the imaging barcode reader for capturing image data and decoding bar code symbols further defines the bar code symbols as chosen from the group consisting of one-dimensional bar code symbols and two dimensional bar code symbols.

44. The device of Claim 33, wherein the controller is in communication with the imaging barcode reader.

45. The device of Claim 33, wherein the controller is in communication with the display device.

46. A method for image capture and display in an imaging barcode reader device including a display, the method comprising the steps of:

capturing a first image with an imaging barcode reader;

storing the first image in a first image capture buffer of a plurality of image capture buffers;

capturing a second image with the imaging barcode reader;

storing the second image in a second image capture buffer of the plurality of image capture buffers;

distributing the first image to the display while the second image is being stored in the second image capture buffer;

capturing a third image with the imaging barcode reader;

storing the third image in one of the plurality of image capture buffers; and

distributing the second image to the display while the third image is being stored in one of the plurality of image capture buffers.

47. The method of Claim 46, wherein the step of distributing the first image to the display while the second image is being stored in the second image capture buffer is further defined as distributing the first image to the display substantially simultaneous with the second image being stored in the second image capture buffer.

48. The method of Claim 46, wherein the step of storing the third image in one of the plurality of image capture buffers after the first image has been distributed to the display is further defined as storing the third image in the first image capture buffer after the first image has been distributed to the display.

49. The method of Claim 46, wherein the step of storing the third image in one of the plurality of image capture buffers after the first image has been distributed to the display is further defined as storing the third image in a third image capture buffer.

50. The method of Claim 46, wherein the step distributing the second image to the display while the third image is being stored in one of the plurality of image capture

buffers is further defined as distributing the second image to the display substantially simultaneous with the third image being stored in one of the plurality of image capture buffers.

51. The method of Claim 46, further comprising the steps of enhancing the first image data stored in the first image capture buffer prior to distributing the first image data to the display and enhancing the second image data stored in the second image capture buffer prior to distributing the second image data to the display.

52. The method of Claim 46, further comprising the step of reformatting the first image data stored in the first image capture buffer prior to distributing the first image data to the display and reformatting the second image data stored in the second image capture buffer prior to distributing the second image data to the display.

ix. EVIDENCE APPENDIX

No evidence is presented herewith.

x. RELATED PROCEEDINGS APPENDIX

No related proceedings are presented herewith.